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SOIL CONSERVATION

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WELLINGTON BRINK EDITOR

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Front Cover: Young William H. Simpson, Jr. becomes acquainted with a three-day-old heifer calf. His dad is a dairyman in the Montgomery County Soil Conservation District, Miss.

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Lynn Stephens, entered by the Page County, Iowa, Soil Conservation District, was the winner of the third annual Midwest Plow Terrace Building Contest sponsored by the Mills County Soil Conservation District.

By GLENNON LOYD

Imagine farmers having fun building terraces with a plow! That's precisely what they are doing in southwest Iowa, where they've made a contest out of what was a ponderous undertaking with heavy or special machinery 10 years ago.

Sponsored by the Mills County Soil Conservation District, the annual Midwest Plow Terrace Building Contest promises to assume its place in the field of rural sports along with corn-husking contests.

In three years, the event has gained a lot of prestige in that section of Iowa, where level terraces and good rotations form an ideal erosion control combination on gently sloping land.

In contrast with the handful of curious who turned out for the first match, 1,500 enthusiastic spectators watched Lynn Stephens, an entry of the Page County Soil Conservation District, win the 1944 event staged on Charles Kayton's farm near Hastings.

With his tractor and 2-bottom plow, Stephens, farmer and tractor operator at the Mount Arbor nurseries, Shenandoah, fashioned 300 feet of 94 percent perfect terrace in less than 2 hours.

Stephens showed a full appreciation of the earth-moving and mounding possibilities of the common moldboard plow, in wresting the title from George K. Welty, 1943 winner, who carried the banner of the Fremont County district. Welty was a runner-up in the 1944 derby.

Competition was keen among the 15 contestants. It included a farm wife, Mrs. Max Shook, one of the Mills County district representatives. And all of them threw up farmable terraces with plenty of water-holding capacity and broad bases on the 10 percent slope.

Judges William S. Speer, Merle Travis, and Faye McManigal reported that the terrace which won Stephens the $100 war bond had an effective

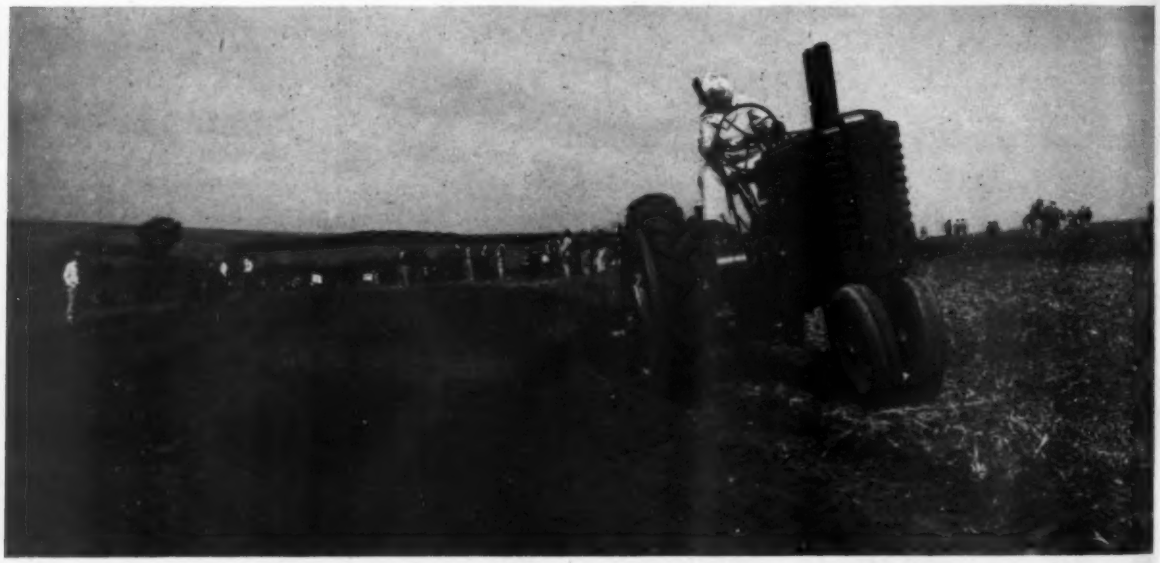
EDITOR'S NOTE.—The author is head, regional current information section, Soil Conservation Service, Milwaukee, Wis.

A. E. Jones, SCS chief of operations, Washington, D. C., and J. F. Wearin, Jr., chairman of the Mills County Soil Conservation District, which sponsored the contest.

Spectators, predominently farmers and their wives, spread over the 35-acre hillslope. As they do at husking matches, many of the watchers clustered around the lands of their favorites. Others moved constantly from one contestant to the next. A frequent remark was "That's simple. I could build one with my plow as easily as they can."

At the top of the field there were several commercial exhibits, as well as some of an educational nature. One tent that attracted many sightseers housed an exhibit of weeds and a display of soil-holding roots of numerous grasses and legumes adapted to that area of the state.

Tasty chicken dinners were served by the Strahan Methodist Ladies Club. A truckload of watermelons, one of the marks of most fall rural gatherings, also did a brisk trade.



Mrs. Max Shook, a Hastings, Iowa, farm wife, was the only woman entrant in the contest which attracted 15 competitors from 7 counties in southwest Iowa.

height of 22½ inches and a channel cross-section of 19 square feet. Speer, a Service district conservationist with headquarters at Denison, Iowa, was the technical expert of the trio. Travis, a cooperator with the Mills District, and McManigal, a cooperator with the Fremont district, were farmers experienced in both building and cropping terraces.

The judges' scorecard follows:

Water holding capacity	50 points
Tillability	20 points
Uniformity of slope	20 points
Efficiency of construction ...	10 points

A shotgun blast at 11 a.m. signaled the start of the event that had many of the trappings and much of the gala air of a cornhusking contest.

All of the 15 contestants, nominated by the commissioners of the 7 soil conservation districts in that territory, were farmers who had previously built terraces with their tractors and moldboard plows, the equipment they used in the derby.

The contest measured the skill of the entrants. But it did much more than that. As they sped back and forth in graceful arcs on their lands, the contestants showed much more dramatically than a mere demonstration that a farmer can build terraces with his own equipment.

The spectators' attention was called to the fact

A view of the east slope of the contest site.

that the terracing system was designed and staked out by Mills County district technicians. And over the loud speaker system, folks were advised to obtain the assistance of district technicians in designing, staking out, and checking completed terraces, as was done at Kayton's farm.

Third place in the event went to Bertel Engstrom, another Page County entry. In addition to Stephens, Welty, Engstrom, and Mrs. Shook, the other participants were: Paul Flowers and Clinton Richie, both of Adams County; Dominic Lickteig, Shelby County; W. T. Lorimor, Jr., Fremont County; R. S. Hibbs, Page County; Ray Kernan and John Stroburg, both of Taylor County; Harry K. Bashaw, Montgomery County; Kenneth Evans, William Buffington, and James Henderson, all of Mills County.

No two followed exactly the same pattern of construction, but they all got the job done. In general, however, they plowed as though they were back-furrowing. In successive waves they plowed and rolled the earth from the channel onto the ridge. They moved furrows uphill to form a gentle backslope.

To bridge the gap between the close of the contest and the announcement of the results, two disk tiller outfits plowed in a 6-foot gully and shaped it for seeding down as a grassed waterway.

That evening there was a dinner for the commissioners of the Southwest Iowa Association of Soil Conservation Districts and an informal meeting at which F. A. Wortman, editor of the Malvern Leader, presided. Speakers included J. F. Wearin, Jr., chairman of the Mills County district, Harry Linn, Iowa secretary of agriculture, Frank Mendell, state conservationist, and A. E. Jones, Soil Conservation Service chief of operations in Washington.

"Our land" said Jones, "is just as long and wide as it ever was, but it's not as thick in lots of places.

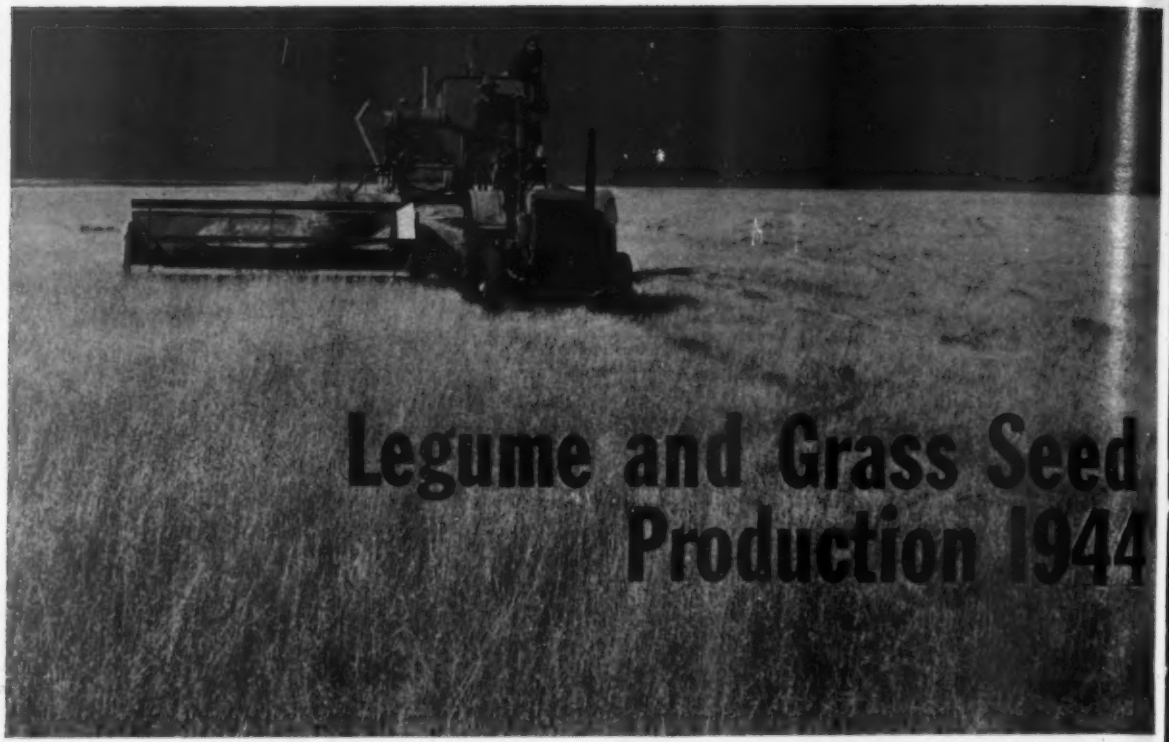
"We must build our soil from the top down, not from the bottom up. We must study to see how we can help nature build or maintain soil value.

"What would happen to your car or tractor if you ran it wide open constantly? It's just as hard on the land to farm it wide open, and we should plan farming operations at all times to have a safe margin in reserve.

"There's no short cut or easy way to do a soil conservation job. It costs money and effort. Our land investment is too large for us to guess what the soil needs."

Wearin and his fellow commissioners, J. M. Steele and D. N. McGrew, Ray W. Jones, district technician, and John H. Longstreet, county extension director, received a lot of commendation for the manner in which they handled the event. Already they are planning for next year.

And the sponsors envision the day when plow terrace building will be an interstate affair, attracting thousands as husking contests do. Already the idea is spreading. Approximately 500 persons turned out to see the first Marion County plow terrace contest held two weeks later in south central Iowa. Donald Van Ryswyk won this event sponsored by the Knoxville, Ia., community club and the Marion County soil conservation district.



Legume and Grass Seed Production 1944

Almost pure native stand of blue grama being combined in Texas with 12-foot machine. Many soil conservation districts have purchased combines recently for seed harvesting, but smaller machines are more popular.

By C. R. ENLOW

The drive for increased production of alfalfa, red clover, alsike, sweetclover, and other legume and grass seeds during 1944 was intense. Farm magazines and newspapers were full of articles concerning the need for seed. Constant reminders were heard over the radio. Wide publicity was given to the acreage and poundage payments for seed production under the AAA program. It's about time to add up results—what was the payoff in seed?

Frankly, results were rather disappointing except for red clover, timothy, orchard grass, bromegrass, crested wheat grass, and ryegrass, few grasses and legumes even approached the 1944 production goals. George Edler, Bureau of Agricultural Economics, has the task of estimating national production of grass and legume seeds, a difficult one at best, but his estimates are surprisingly close, judging by past years' records. George's reports come out promptly, as soon as he receives enough field reports to prepare estimates, at the time I write, the figures for 1944 have all been released except for lespedeza. The lespedeza estimate was to be released November 10.

Here are some headings of Edler's releases: "Alfalfa Seed Production This Year May be 15 Percent Below that of 1943"; "Alsike-Clover Seed Production This Year Expected to be Little Larger Than in 1943"; "Red Clover Seed Production Much Larger than in 1943 But Carry-Over on Farms and by Dealers Much Smaller"; and "Sweetclover-Seed Production Much Larger Than Last Year but One-third Below Average"; and so it goes.

The Seed Production Programs Committee of the War Food Administration last spring recommended definite action to secure more seed. The recommendations included (1) support prices for several seeds, in order that farmers would know that market prices would not fall below specified prices; (2) additional payments per pound for harvesting seed of alfalfa, red clover, alsike clover and others of which the seed supplies were critically short, provided the seed was marketed by a specified date; and (3) that an intensive program through the press, radio, by meetings and individual contacts with farmers be started to secure

EDITOR'S NOTE.—The author is chief, agronomy division, Soil Conservation Service, and chairman, Seed-Production Programs Committee, War Food Administration, Washington, D. C.

more seed. The task force of the seed trade, a group of commercial seedsmen appointed by the War Food Administration to advise and assist with seed problems, worked diligently with the seed committee and also independently to secure increased seed production. State Experiment Station and Extension workers devoted a lot of time and effort to the need for more seed.

For the specific purpose of encouraging an increased harvest of legume and grass seeds, Congress increased the appropriation of the Agricultural Adjustment Agency by $12,500,000. This money made it possible for that Agency to expand the harvesting of legume and grass seed practice which had already been provided for in the 1944 Triple-A program. In addition to making payments on an unlimited acreage for harvesting legume and grass seeds, enough money was available for making small poundage payments for harvesting seed of alfalfa, red clover, and alsike clover.

The following table gives the estimated production for 1944 of seed of several legumes and grasses. The goals are also given. These were prepared after full consideration of needs for seed for use on farms, for military purposes, and for export to our allies through lend-lease and relief channels. Production figures of recent years are given for comparison.

Legume and grass seed production estimates, 1944, compared with established goals and recent years' production (in thousands of pounds, thresher-run seed)

	1944 production (estimated)	1944 goal	Average annual production 1937-41	1942 production	1943 production
Alfalfa	60,354	102,000	76,307	58,854	70,734
Red clover	108,354	115,000	90,599	61,566	69,354
Sweetclover	35,862	67,000	65,620	37,518	25,692
Alsike clover	14,886	27,000	19,562	15,144	13,614
Sudan grass	55,200	71,000	67,974	40,440	31,500
Bromegrass	*13,630	9,000	**	*9,080	*8,470
Orchard grass	9,744	9,700	***6,108	8,582	8,148
Timothy	60,840	58,000	95,022	75,532	74,367

* Clean seed.
** Not available.
*** 1938-42 average.

It is interesting to note that although the production of alfalfa seed was about 15 percent smaller than in 1943, it is estimated that farmers harvested 774,000 acres, which is more than the 763,800 acres harvested in 1943. Unfortunately, weather conditions before alfalfa seed was ready for harvest in the Great Plains reduced acre yields materially and undoubtedly resulted in the harvesting of a much smaller acreage than had been planned.

An increased production of red clover is expected in the States in the Central Corn Belt, particularly in Illinois, Missouri, Ohio, Indiana, Iowa, and Kansas. Washington also is expected to produce more seed than last year. Most other States normally producing red clover seed probably produced less than in 1943.

In addition to the legumes and grasses listed in the above table, there are several others of considerable interest. Ladino clover, a comparatively new but exceedingly popular crop, has an estimated seed crop of 880,000 pounds, more than double that of last or any previous year, but still far below the goal of 1,500,000 pounds. The production of Austrian winter pea seed is estimated at 46,000,000 pounds, less than one-third of the 1943 production of 150,500,000 pounds, and slightly below the 5-year (1938-42) average of 55,040,000 pounds. Because of the tremendous production in 1943, a large surplus has been carried over into 1944, and the available supplies for seeding this fall were more than adequate.

Crimson clover seed production is estimated at 13,860,000 pounds, some 3,000,000 pounds less than the goal. Crested wheatgrass jumped to 25,030,000 pounds, approximately four times the 1943 production. This seed can be harvested as readily as wheat, and a combination of support price and an acreage payment for harvesting resulted in a tremendous seed crop. For once there is ample crested wheatgrass seed to plant many thousands of acres of abandoned cropland and depleted ranges that need reseeding in the Northern Plains, if machinery can be set in motion to get the job done.

The production of common ryegrass seed is estimated at 31,500,000 pounds; white clover at 1,290,000 pounds, slightly more than half the 1943 production of 2,310,000 pounds, but still above the 1938-42 average production. Hairy vetch seed production is estimated at 19,330,000 pounds, scarcely more than half the desired production; common and Willamette vetch, on the other hand, jumped from 26,800,000 pounds in 1943 to an estimated 38,400,000 pounds in 1944, and may result in a surplus, as these varieties are not so winter hardy as hairy vetch and the demand for the seed is not so great.

Seed production of Kentucky bluegrass and redtop was exceptionally low in 1944, but this is not serious, as these grasses are used more for lawn seeding and are not particularly important in the food production program. A million pounds of meadow fescue seed is the estimated production, which is above the 5-year average of 825,000 pounds. This grass at present is used mostly for export, being popular in the British Isles.

Crested wheatgrass can be handled like wheat. This scene might easily be confused with the harvesting of wheat. Kenneth King, assistant state conservationist, sits on a 2-foot silt bar washed from an up-and-down field planted to corn, near Ames, Iowa.

Among the comparatively new legumes and grasses that are coming into seed production in the Southern States, blue lupine is estimated at 6,400,000 pounds of seed, nearly one and a third million pounds higher than the 1943 production. This is a marvelous record for a new crop. Production figures are not available on wild winter peas and crotalaria, but there is little doubt that seed of these crops has been materially increased.

Native western grasses were eligible for the AAA harvesting payment, but no estimates on production are available. It is hoped that there will be a material increase in seed supplies of the bluestems, gramas, wheatgrasses and many others.

There is no doubt that the interest that soil conservation district supervisors have taken in seed production has had a lot to do with maintaining and increasing the production of grass and legume seeds. Of course, it is impossible to guess what seed production in 1944 would have been without all the campaigning that has been done, but judging by the trend the past two years, there is not much doubt that it would have been much less than was secured. Soil Conservation Service technicians who have devoted efforts during 1944 toward increased seed production are to be commended. An effective soil conservation program cannot be applied to the land without ample supplies of grass and legume seeds, and neither can the high production records of food and feed crops be maintained for long, as grasses and legumes are necessary to conserve the soil and keep it productive. Grasses and legumes are the principal agronomic tools to effect conservation, and efforts must be continued the coming year to increase seed production of these plants.

About 30 million acres could be brought into production through drainage alone. Millions of other acres need such treatment as terracing, contouring, strip cropping, gully control, stock-water ponds, and plantings of grasses, legumes, and trees, according to the needs of the land. We need this now for top production; and it is needed at all times for national security.

These and other types of beneficial work on the land would provide the best kind of employment for ex-service men. Many boys in the armed forces write us that this is what they hope to do. Their work would help lay a solid foundation for our agricultural plant of the future. With this help, and adequate technical assistance, farmers could apply conservation measures necessary to build up their soil to maximum production. We know where the work is needed and we know how to do it.—*H. H. Bennett.*

GONE WITH THE CLOUDBURSTS

William L. Tayloe of the Mahaska County Soil Conservation District office, Iowa, observes some of the 6-inch gullies washed in a field where corn had been planted up and down the slope. Harrowing failed to erase the gullies formed by the heavy rains.

By FRANK H. MENDELL

George McCalmant, who lives in the town of Wyoming, is one Iowan who'll never forget the wrath of the storms that walloped the state in May and June of 1944.

A flash flood in Little Bear Creek swept McCalmant from inside a garage where he sought shelter. Carried downstream by the rushing current, he managed to grasp a bridge, which he clung to until it, too, washed away. When rescuers finally got him, McCalmant was clinging to a tree.

While McCalmant will remember the storms because one almost cost him his life, many Iowa farmers will recall them because they swept away a lot of life from their slopes and hillsides.

EDITOR'S NOTE.—The author is state conservationist, Soil Conservation Service, Ames, Ia.

Kenneth King, assistant state conservationist, sits on a 2-foot silt bar washed from an up-and-down cornfield near Ames, Ia.

Iowa's farmland experienced its most frightful run of soil washing in history during May and June of 1944. Never before had so much of the state's land been open and at the mercy of the raindrops.

Naturally, the swollen streams and flooded rivers grabbed the big headlines. The Missouri, the Little Sioux, the East Nishnabotna, the Raccoon, the Des Moines, the Skunk, the Iowa and the Mississippi all were on the rampage.

Farley Henkes, cooperator with the Clayton County Soil Conservation District, Iowa, cultivates corn on one of his strip-cropped slopes. Henkes, who has had a soil conservation program for 8 years, says it has stopped serious erosion and increased crop yields one-fourth.

But for the first time the fearful erosion, the washed-out crops and the water-logged uplands captured a share of the attention.

We estimated, I believe conservatively, that the persistent heavy downpours washed away some $154,000,000 worth of soil from the 5,000,000 acres of sloping land that were exposed.

Our estimate was based on an average loss of 35 tons per acre, but observations of our staffs working with Iowa's 45 soil conservation districts disclosed that there were many fields that lost as high as 200 tons per acre.

Two localized storms give an idea of the force that nature unleashed upon the unguarded slopes and inadequately drained level uplands.

At Ames, where our state office is located, we had one rain that statisticians told us could be expected only once in 10,000 years. On ground

that was already pretty well saturated, 8.21 inches fell in 37½ hours.

In the rugged country north of Dubuque, the little Maquoketa river, in disgorging the excess storm water from one of the soakers, carried a silt load that amounted to more than 3 tons of soil per acre from the whole 130 square mile watershed. From this one rain the small stream dumped silt equal to a 7-inch layer of topsoil on 230 acres.

To convert the soil loss to a dollar and cents basis, we valued the topsoil at $1 per ton, a most conservative figure. One city resident wrote that

Sweet clover seeded in corn following by last cultivation in 1943 guarded this 35-acre slope against washing during the big rains of May 1944. William Streeter, Marion County farmer, observed that the rank growth also helped to remove the excess moisture from his land.

he'd take all the topsoil I could deliver at $1 per ton.

Many Iowa farmers noted that they could help temper the rise of the rivers by holding more of the rainfall on their own slopes. Milo Wolrob, a cooperator with the Linn County Soil Conservation District, reported that contoured rows in his cornfield held all the water on his slopes during a 3-inch downpour.

"Similar rains in other years," Wolrob said, "left many gullies on the slopes and covered up the corn at the foot with silt. This year there was practically no washing on the slope, and no silt down on the flat below."

On the farm of Thomas Glenn, who cooperates with the Wapello county district, corn planted on the contour on land plowed out of alfalfa sod showed no signs of erosion. On a similar slope that was in corn in 1943, and planted to corn again, up and down hill, gullies formed in each corn row.

In numerous areas, however, the big rains illus-

Grant Sidebottom cultivates corn on a terrace backslope on the farm of E. G. Knoke, a cooperator with the West Pottawattamie County Soil Conservation District. These plow-built terraces stopped soil washing.

trated the need for a complete soil conservation and drainage program. A single practice, such as contouring, just wasn't enough. From the Mills county district Ray W. Jones reported: "Contour planting of corn has been less successful than in former years, there being more breaks, even on those fields that were laid out accurately. We're of the opinion that a large amount of this trouble is due to improper land use rather than to the amount of rainfall, for even among our conservation farmers we find instances of corn following corn for their third and fourth year on the more sloping land."

Paul Harp, a cooperator with the Marion County District, found that although his terraces ran some water, "I didn't have any serious erosion on the terraced fields. The rains showed us that we need more than contour rows and buffer strips of grass to control erosion on our fields."

And E. S. Loyd, a cooperator with the Mahaska County District, pointed out that terraces need to be teamed with a good rotation in line with the land's adaptability to work effectively.

All of the new terraces that Loyd had built in sod ground and planted to corn showed no silting in the channels. Some older terraced in a field that went into beans for the third straight year silted about half-full.

In contrast, John Soderburg, a cooperator with the Adair County District, who has followed his

(Continued on page 127)

Downstream Interests

By CARL B. BROWN

Ruin of cropland on Ohio River flood plain by deposition of sterile sand during flood of January 1937.

A large and growing class of downstream interests is affected by the products of erosion—increased floods and sediment. For the most part these interests have not recognized their direct responsibility to share in the job of soil conservation. Why? The most apparent answer is that soil conservationists either have not determined the effect of soil conservation on their problems or have failed to "sell" them on the soil conservation program. Let us look at a few of the 10 major types of downstream public and private enterprises that have a stake in the use and conservation of uplands, namely: (1) valley agriculture (2) drainage (3) irrigation (4) flood control (5) commerce (6) fisheries (7) recreation (8) public health (9) power and (10) water supply.

VALLEY AGRICULTURE

The ill effects of flooding and infertile sediment deposits on valley croplands are so widely distributed that nearly all soil conservation districts are faced with some problems of this character. The total annual loss to valley crops and croplands from floods and sediment is measured in terms of hundreds of millions of dollars. As a "horrible example," consider the Little Tallahatchie Watershed in Northern Mississippi where erosion has advanced to an extremely critical stage. This watershed, containing 867,476 acres—a little more than 1,000 square miles, was opened for settlement just a century ago. Approximately 8¼ percent of the area consists of alluvial flood plains. In three generations 294,000 acres have been forced out of cultivation as a result of erosion and about 75,000 acres are virtually ruined by gullying. As a result the runoff is so rapid and the stream channels so clogged with sediment that a ½-inch rain causes damaging floods. Excessive flood damages now affect 65 percent of all of the 71,800 acres of bottom land. In a normal year, about 15 floods occur somewhere in the watershed, of which 4 normally occur during the growing season. The average annual flood-water damage to crops alone amounts to $301,483. But over and above this, the present agricultural damage from sedimentation on flood plains and in stream channels is estimated to be

EDITOR'S NOTE.—The author is head, Sedimentation section, Soil Conservation Service, Washington, D. C.

$591,023 annually. The latter figure represents the cumulative loss in productivity of all flood plain acres affected by sedimentation, and it is increasing year by year.

This flood and sediment damage all occurs *above* a major flood-control reservoir—the Sardis Dam. It is particularly significant to the soil and water conservation program that about 75 percent of all flood damages occur on headwater tributaries generally *above* the protection of major flood-control reservoirs and levee systems. These damages to innumerable small acreages are largely agricultural and are almost completely overshadowed by the more spectacular 15 percent of damages to urban areas and 10 percent of damages to main stem floodplains. Yet the 75 percent can be controlled only by soil conservation and small structures.

Valley landowners need to be shown the relation between their problems and the roots of these problems on the uplands. They must understand where and how they can contribute to the soil conservation program for their own benefit, even though their contribution may apply to remedial work on their neighbor's land above.

DRAINAGE

Drainage is one of the major types of capital improvements in agriculture. To 1940, more than $690,000,000 had been invested in drainage enterprises. More than one-half of this amount was spent in the construction of open ditches. The annual expenditure for maintenance of open ditches is approximately $1,800,000. A large share of this cost is for removal of sediment coming from eroding uplands. The actual cost of sedimentation to drainage enterprises is probably much greater than this figure would indicate, for many ditches are not properly maintained, as a result of which the entire capital investment gradually is being lost. In many places it would be considerably cheaper in the long run for drainage districts to cooperate in an erosion control program than to bear indefinitely the annual expense of ditch cleaning.

IRRIGATION

As of 1940, slightly more than $1,000,000,000 had been invested in irrigation enterprises in the western states, and the area that could be irrigated by the then existing works comprised slightly more than 28,000,000 acres. The annual cost of maintenance and operation of the irrigation enterprises was a little more than $43,000,000. A considerable share of this cost was for cleaning silt from irrigation canals. For example, a careful survey has been made of the cost of cleaning irrigation ditches in the Sevier River Watershed, Utah. The cost of maintaining ditches subject to flooding and excessive sedimentation from overgrazed mountain watersheds was compared with the cost of maintaining ditches which are relatively free from flood and sedimentation damages. The analysis shows that the cost of cleaning 160 canals and laterals representing 1430 miles of ditches was $19,898 per year more than the cost would have been if the water coming into these ditches had been derived from well vegetated drainage areas similar to those above the check ditches.

In addition to the large annual ditch-cleaning cost, irrigation enterprises are faced with the serious cumulative problem of silting of irrigation storage reservoirs. More than 1800 such reservoirs have been built in the western states at an estimated cost of $395,000,000, and this does not include the apportioned cost of multiple-purpose reservoirs such as Boulder Dam. The annual silting damage to these reservoirs amounts to several million dollars.

POWER

In 1942, stationary power plants in the United States generated approximately 235,000,000,000 kilowatt hours of electricity. This is approximately 2/5 of the world's total power production. No wonder this country could develop so rapidly the most powerful military force in the world. Approximately 1/3 of our power production comes from hydro-electric plants. The average revenue per kilowatt hour for all classes of power sold in 1942 was 1.79c. At this rate the revenue derived from water-generated power would be approximately $1,145,000,000. The total investment in approximately 3,000 power dams and reservoirs has been $2,850,000,000, not including power-transmission lines and other facilities for distribution.

A major part of our water power depends on water storage reservoirs. No estimate has been made of the average annual damage from silting to this, our largest class of major reservoirs, but during the drought of 1941 the power loss in four Southeastern states due solely to the effect of silting in the power reservoirs of those states was esimated to be 90,000,000 kilowatt hours. This power was lost just at the time it was most urgently needed a the beginning of our war-time production program and was particularly felt in aluminum and certain other critical industries. At the national average sale price of electricity this

Calloway irrigation canal on north side of Kern River, Calif., almost completely filled with sand. (Photo by courtesy U. S. Forest Service.)

represented a loss of $1,600,000 due exclusively to sedimentation. Here is one major branch of American industry which is suffering severe losses from the effects of soil erosion, that so far has made no direct contribution to the conservation program.

WATER SUPPLY

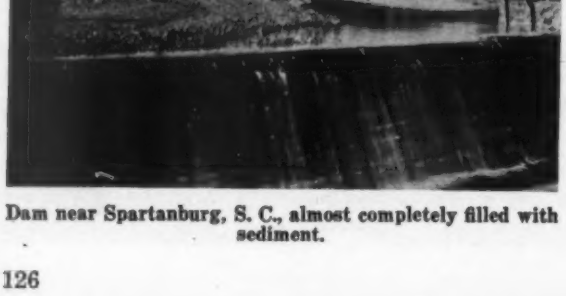
Approximately 32 million in this country and a large share of our industry uses filtered water, that is, water from which it has been necessary to remove the fine suspended soil particles, the products of erosion. The quantity of water annually filtered in the United States is something like 1,400 billion gallons. An investigation in the Piedmont of North Carolina showed that the average cost of chemicals used in water purification in that region was $5 per million gallons treated. It was found that an average 25 percent reduction in the suspended sediment load of a water-supply source, which would be a modest expectation from an adequate soil conservation program on a water-

Damage from sediment deposition to farm homestead and machinery in Republican River Valley near Guide Rock, Neb.

Panorama of delta at upper end of Loch Raven Reservoir, which provides water storage for Baltimore, Md. Approximately 1300 acre-feet of sediment have been deposited in the area shown, occupying reservoir space which cost $68.37 per acre-foot.

shed, would reduce the cost of chemicals in this region by $1.50 per million gallons. Considering that this is a region of relatively large silt loads, if a saving of only $1 per million gallons on an average throughout the United States could be achieved by conservation programs, the annual savings in cost of water filtration would be $1,400,000.

Over and above this cost is the damage from silting to water-supply reservoirs. It is estimated that approximately 26,000,000 persons, or 20 percent of our population, depend on 2,700 water-supply reservoirs which have been built at a cost of more than $566,500,000, exclusive of waterworks and distribution lines. It is estimated that as a result of silting alone, 21 percent of these reservoirs will have a useful life of less than 50 years and another 25 percent will last less than 100 years. Many cities and private water companies throughout the United States have long recognized the need for watershed protection and have carried out extensive reforestation programs. Hundreds of cities, however, have reservoirs on watersheds of relatively high-value agricultural land which cannot be purchased for watershed protection. Many of these watersheds are entirely within soil conservation districts. Many cities and water companies would be not only willing but anxious to participate in a conservation program if (1) they were aware of the rate of silting in the reservoir, (2) the sources of the damaging sediment were determined by adequate surveys and (3) the city people were convinced through information that expenditure of city funds on the watershed for conservation would lower costs of water treatment and ultimately lower taxes.



Dam near Spartanburg, S. C., almost completely filled with sediment.

RECREATION

Recreation is big business in the United States. Several hundred million dollars a year are spent for outdoor sports—hunting, fishing, swimming, boating, etc. Any handicaps to these sports represent a tangible loss to the individual who is willing to pay for them and will not spend his money on a substitute, and it certainly represents a loss to the community in which the individual would spend his money. Soil erosion and excessive frequency of flooding are causing recreational losses to many communities of which they may not be aware. For example, in the Meramec River Watershed, Missouri, studies by the Missouri State Planning Board showed that in 1940, 834,350 persons used this watershed for recreation during the period May 15 to September 30. The expenditure per person per day was valued conservatively at $1 above the normal cost of living. When the stream flow is above normal, and the water is muddy, recreational attendance was found to drop 33 1/3 percent because fish won't bite and swimming is poor. These conditions prevail during an average of 23 to 29 days of the recreation season. When the rivers were actually in flood, recreational attendance dropped 80 percent during an average of 1 to 4 days in the season. After making allowance for non-attendance during an average of 5 days of rain and for deferred recreation, the loss in recreational person-days due to floods has been estimated at 11,685 and due to silty water 49,090, an annual monetary loss on this basis of $60,775.

There are some 1,200 sizable recreation reservoirs in the United States which are estimated to have cost $67,500,000. These reservoirs are silt-

ing, some of them quite rapidly, as are our reservoirs for power, water supply, irrigation and other purposes. In some reservoirs, such as Lake Isaqueena on the Clemson LU-Project, the water stays muddy so much of the time that swimming has been prohibited. In other reservoirs, such as Lake Lure at Chimney Rock, N. C., silt deposits over the man-made sandy beaches have greatly damaged recreational facilities and caused loss of property values to hotel and residential developments around the lake.

What about the practicability of some of the license fees and charges for use of recreational facilities being applied to conservation in the interest of preserving these facilities for public enjoyment?

CONVINCING THE FOLKS DOWNSTREAM

The steps necessary to secure the direct participation of all 10 major groups of downstream interests in the soil and water conservation program are basically the same as those necessary to "sell" the single farmer and rancher. The main job is (1) to determine through research the nature and extent of these downstream effects of erosion and their cost to specific individuals, towns, industries, etc., (2) to determine through surveys where measures need to be applied to correct these specific damages, and (3) to sell the affected parties through information and education on the benefits from cooperative action. Fortunately, the organizations for action, the soil conservation districts through which these affected parties can cooperate for their own protection, are already rapidly being formed. Some additional research is needed in the development of new and supplementary control measures, which are not ordinarily needed for the control of erosion on the farm, but by and large the measures that will cure the farmer's problems will also remedy most of the difficulties downstream.

Two thoughts are worth bearing in mind when it comes to cooperation. First, people don't like to spend their money without reasonable assurance of specific benefits therefrom. Second, people don't like to spend their money for something that seems to be of more benefit to somebody else than to themselves. In several attempts to develop farmer-city cooperation in protecting a city water-supply reservoir such a feeling has developed among the city folks below or the farmers above. While it is true that incidental benefits from conservation by any party will almost always accrue to some other party, the specific phases of conservation that will be of greatest benefit to upstream and downstream parties are often not identical but complementary. In many watersheds the worst damage downstream arises from severely gullied, abandoned or low-grade land which the landowners are most reluctant to treat. Usually the landowner should be urged to place emphasis on the protection and conservation of his *best* lands—those parts of the farm where returns from conservation will be greatest. Emphasis to downstream interests, on the other hand, should be placed on conservation of those parts of the watershed, and those sections of the farms, which produce the highest runoff and the greatest sediment loads. In many areas the contribution of downstream interests to erosion control on the worst lands would complete the farm conservation plan which the farmer himself may be unable to do.

GONE WITH THE CLOUDBURSTS

(*Continued from page* 122)

complete conservation plan closely, reported that he had never seen as much water come out of his terrace outlets before. But the excess storm water, he asserted, was as clear as a mountain stream.

Harold J. Nilsson of the Linn County district office reported that strip-cropped fields, too, handled a 6-inch rain of 3 hours duration, much better than did up-and-down fields in a 27,000-acre area of the county. He observed that the straight-rowed fields lost 4 or 5 times as much soil as comparable strip-cropped fields. Silt washed from the cropped strips was caught by grass and grain strips.

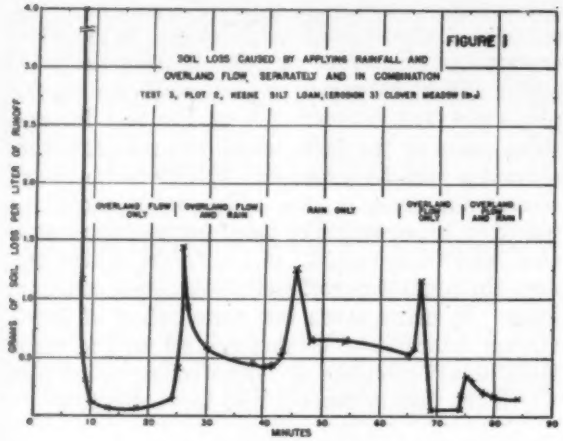
Kenneth Adkisson, a cooperator with the Jefferson country district, had no silt deposity in the grassed waterways of his contoured and strip-cropped fields. But in an adjoining field that had been in straight rows of corn and beans last year, there were gullies from 6 inches to 1 foot deep between the corn rows, and waterways were cut out from 1 to 2 feet deep.

In addition to the vast damage caused by washing, we had some 100,000 acres that stood idle because of improper drainage or flooding and siltation. Paul Jacobson of the Webster county district office, said that crops on approximately 30,000 acres in the county were killed by high water and inadequate drainage. Two-thirds of the acreage was replanted to corn or soybeans, but the remainder, mainly small areas within fields, either stood idle, or were used only for emergency crops.

Farmers and our men learned a lot from the

(*Continued on page* 135)

RAINDROPS, SURFACE FLOW AND EROSION



By W. D. ELLISON

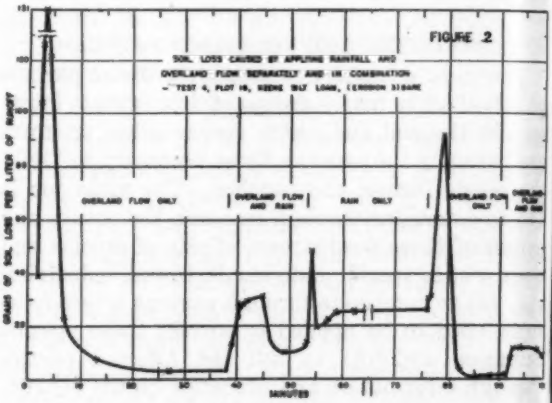
Recently I made some soil erosion tests by applying rainfall and surface flow alternately and in combination, so that I could observe which caused the most erosion. The rainfall was applied with a standard type of "rainmaker" and the surface flow was applied at uniform depth across the full width on the uphill end of the plot. This flow was to simulate runoff which moves down out of one band of a strip cropped field and flows across another at a lower level.

The accompanying curves show the results. When rainfall ceased, the surface flow cleared up and, when it was turned on again, the surface flow muddied. It is an easy matter to demonstrate that the full carrying capacity of the flow was not taxed by the soil carried off the plot. The rate of tearing the soil loose from the surface and entraining it in the flow was the controlling factor in the erosion process.

When the surface flow was first turned onto the plots it picked up the loose flakes of soil and dust particles lying loose on the surface. After this loose material was gone the surface flow didn't carry much soil again until the raindrops were turned on to help dig or tear more soil loose. From evidence such as this we may infer that one of our big jobs in soil conservation work is to intercept raindrops, and prevent their falling directly on the soil surface. This is where cover crops and mulches serve so well.

EDITOR'S NOTE.—The author is hydraulic engineer, division of drainage and water control, research, Soil Conservation Service, Washington, D. C.

It is very easy for us to see a few large streams of flowing water as they carry soil down the hillsides, often transporting tons of erosional debris as fast as a fleet of large trucks might move dirt away from a power shovel. But it is impossible for us to see the billions of raindrops doing the "pick and shovel work" which loads these water streams with the fertile topsoil from the many acres of smooth field surfaces. Under these conditions we are almost certain to underestimate the effects of raindrops and to overestimate the effects of surface flow.



The test shown in the first figure was made on a plot having oats stubble with a poor stand of timothy and clover about 3 to 5 inches high. In the second figure the test was on bare soil. The curves are very similar in shape and height of rise, but it will be seen that the vertical scale in the second figure is 40 times that of the first. This then, means that the amount of soil lost from the vegetated plot was just one-fortieth of the amount lost from the bare plot. A lot of this erosion control on the vegetated plot can be traced to the interception of raindrops by plants.

Most of the soil-laden streams and the gullies they cause in the hillsides are outward manifestations of deeper and more basic troubles. As the raindrops "pick" the soil loose, they also separate the particles, break down the granules, and mix, puddle and compact a shallow layer of the surface soil until a highly impervious surface seal is formed. In some soils this seal will almost "water-proof" the land.

To correct these primary troubles we must first control the destructive actions of raindrops. Some of the developments needed to improve on this

part of our job include improvements in the use of cover crops and plant residues for protecting the soil against raindrop impact, and improvements in both crop rotations and soil management practices for building and strengthening soil aggregates. By protecting the soil with cover crops against raindrop impact, and strengthening the aggregates through soil management, one gets at the source of erosion, prevents damage to the soil, and preserves its structural properties and infiltration capacity at points where the raindrops fall.

GULLY HEAD CONTROL IN DEEP LOESS

By E. T. FERGUSON

Gully control structures are "but a memory" throughout most of the Southeastern United States, but in the fertile loessial soil along the Mississippi River concrete flumes are doing an important gully control job.

In this unstratified material, the face of the gully head, where the water pours in, stands vertical and the soil melts away like brown sugar when runoff from a drainage area even as small as one-fourth of an acre pours into the gully during a heavy rain. A gully 2 to 30 feet deep may advance uphill 40 or 50 feet during one storm. So far, no method has been developed for controlling the gully head with vegetation alone.

In Adams County, Miss., this form of erosion was destroying large areas of fertile soil that produces high crop yields and makes excellent pasture. At some point in every drainage way in the deep loess section of the county could be found a deep vertical-faced gully head. When the Adams County Soil Conservation District was organized, the problem of controlling these gullies was still unsolved.

In studying the problem in connection with the district program, a concrete flume was located on the Landsdown Plantation that had been constructed in 1916 and was still in good operating condition. This structure was simply a concrete trough, extending six feet over the lip of a gully, that discharged water from five acres of land to the gully floor 27 feet below. The force of the water had formed a natural stilling basin three feet deep in the floor of the gully.

On the basis of the performance of this structure, the commissioners of the Adams County Soil Conservation District authorized the design and construction of a flume on this principle. In cooperation with the district commissioners, the County board of supervisors of Adams County furnished a concrete mixer, hand tools, and lumber for construction of portable forms, which were designed so that they could be assembled to form any size flume desired. Flumes of this type are now being used to control gully heads on many Adams County farms.

Construction of one of these flumes, involving the use of 2.2 cubic yards of reinforced concrete which costs the farmer $30.18, required one day's time of six men for excavation, setting the forms, and pouring the concrete. Moving earth for a dam and diversion ditches cost $10.30, making the total cost $40.48. The drainage areas was 8 acres, making the protection cost $5.06 per acre, which is not excessive in view of the value of the land and buildings protected.

The discharge end of the flume is constructed to the edge of the gully and, as runoff water pours from the flume, the gully head caves back under the flume, the distance varying from 1 to 6 feet. After the gully head has caved back under the flume and is protected by the concrete structure above it, the gully head will stand vertical and its progress will be stopped.

Since the trough of the structure acts as a cantilever beam after the gully head has caved a few feet back under the discharge end of the trough, it is necessary to reinforce the upper edge of the beam with deformed steel bars to take care of the tensile stress in the upper edge of the beam. The headwall is also reinforced vertically and horizontally. Steel stirrups are placed in the side wall of the flume which extend through the floor and up the other side.

This reinforcement is of prime importance of the overhanging portion if the flume is to be prevented from breaking off. An additional safety feature may be the construction of a fuse plug at some point in the earth dam. This will take care of the possibility of the flume's being plugged with debris or being overtopped by rainstorms of unprecedented proportions.

EDITOR'S NOTE.—The author is work unit conservationist, Soil Conservation Service, Natchez, Miss.

Bank cover is essential to maintaining ditches at reasonable cost. Here's a drain cloaked in kudzu.

DISTRICTS EXCHANGE WATER FOR LAND

By JOHN G. SUTTON

Drainage is a first step toward conservation farming of flat, heavy, wet lands. It is a normal prerequisite to crop rotations, lime, fertilizers and legumes. It is often a necessary prelude to the development of a complete and balanced soil conservation program.

Frequently, however, the proper role of drainage is obscured. And it is one of the responsibilities of soil conservation district supervisors to keep the matter of drainage in its proper perspective, to insist firmly that due emphasis is given to every phase of the soil conservation program.

Drainage is often extremely profitable. It frequently pays for itself within one to three years. This fact should generally indicate to districts that only limited assistance is necessary from Federal sources and that the farmer may reasonably be asked to finance the major cost of such work himself. Sometimes, however, the extent of the public interest is such as to justify special assistance.

Generally, the Soil Conservation Service can furnish technical assistance only on farm drains as a part of farm conservation plans, and on small or medium size group jobs. Limited amounts of heavy equipment are available to districts. Such equipment is used chiefly for work of demonstrational value, in areas where contractors' equipment is not available at reasonable prices, and for jobs too small to contract.

It is interesting to review what some of the soil conservation districts have been doing about their drainage problems. Take, for example, the Newton County Soil Conservation District, which lies in the north portion of Indiana adjacent to the Illinois line. The county is largely covered by public drainage enterprises. The 1940 drainage census gives the land area of the county as 264,320 acres, of which 220,682 acres are assessed for 114 public drainage enterprises. There are 378 miles of public open ditches and 125 miles of public tile drains. Many of these public drains need rehabilitation and improvement and there are many farm drainage problems throughout the county.

The Newton County Soil Conservation District has a very interesting letterhead. Underneath the words "Newton County Soil Conservation District" is the following statement: "An organiza-

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Editor's Note.—The author is head, drainage section, Engineering Division, Soil Conservation Service, Washington, D. C.

tion of the farmers, by the farmers and for the farmers, promoting soil and water conservation and wise land use." At the bottom of the page is the invitation, "Call on us if you have drainage, erosion or soil fertility problems." The members of the Board of Supervisors are listed at the left and the five cooperating agencies are given at the right. The latter include Extension Service, Purdue University; Indiana Department of Conservation; Newton County Commissioners; Soil Conservation Service, U.S.D.A.; and State Conservation Committee.

In a special report prepared September 1, 1944, the district noted 18 requests for assistance on drainage jobs. Eight of them were for small groups of 2 or 3 farmers. The largest job benefited 12 farms involving 5,900 acres at a cost of $27,232. On this job $11,000 of reallotted conservation and use funds was furnished in accordance with the special program worked out in cooperation with the Agricultural Adjustment Administration.

On another of the jobs, benefiting 22 farms and 2,000 acres, the Service furnished rental of a dragline, which represented about half of the construction cost. Even though special assistance was granted on these two jobs (partly for demonstrational purposes), the other 16 jobs have gone forward without special assistance and groups of farmers have paid, or are arranging to pay, for the construction costs without Federal assistance.

The district not only has done creditable work in drainage but is also encouraging a well-rounded soil conservation program. It obtained a set of sewer rods and scoops for loan to farmers with which large tile lines could be cleaned readily. Yields of crops, checked by the district farm planner and county agent, indicated a 10-bushel gain in corn production and 4-bushel gain in soybean production when planted on the contour, as compared with similar fields planted in straight rows. It was found that an addition of 200 pounds of 0-9-27 fertilizer would produce increases in yields ranging up to 5 to 10 bushels of soybeans per acre on the black sandy loams. Other practices in the well-rounded program included grass planting, liming, fertilizing, terracing, diversions, waterways, protection of woods, cover crops, farm drainage, and woody plantings. The success of the district is indicated by the fact that another part of the county has recently petitioned to join and has been added to the district.

The Knox County Soil Conservation District at Vincennes, Ind., in its special report of September 1, 1944, noted the planning of 27 group drainage jobs, and the completion of 18 jobs benefiting 3,610 acres on 71 farms. The Service furnished technical assistance only, and the groups spent $22,722 to construct about 19 miles of open ditches involving 209,635 cubic yards of dirt. Improvement of the Roberson Ditch was described in the January 1944 issue of *Soil Conservation*. In the annual report for 1943 the district supervisors stated that the increased yields obtained on 2,565 acres drained during the year would be equivalent to 20 bushels of corn per acre. The estimate for the drainage jobs completed in 1943 includes both public and private drains. The Knox County District also has the other features of a well-rounded soil conservation program. In this instance no special assistance was given on excavation work, and dragline work was done by contract at the expense of the farmers.

The rate at which a well organized program moves when qualified specialists are available is shown by progress in Clark County, Ohio. The following is quoted from the 1943 annual report of this district's supervisors:

"We also have in the district a ⅝ yard dragline, which, after a few minor adjustments, will be put on a drainage project which is all ready to go. We have 2 drainage projects ready for the work and 6 applications waiting. This drainage work will be one of the outstanding programs in the district after it gets under way.

"Because of the difficulty of arranging drainage projects through County government, practically nothing has been done in the County for years outside of a few jobs completed by the CCC a few years ago.

"The supervisors also insist, wherever possible, that drainage applicants sign agreements to follow certain soil conservation practices along drainage projects."

In this district, between January 1, 1944 and August 30, 1944 surveys were completed on 7 group jobs which will benefit 26 farmers and 1,851 acres. Of these, 5 small jobs were completed, the average length of each job being 3,056 feet and requiring excavation of 3,280 cubic yards of dirt.

Good progress was also recorded in the Dodge County, Wis., Soil Conservation District.

In the first eight months of 1944 surveys were completed on 6 group jobs draining 1,556 acres. That drainage greatly improved the 61 farms involved is shown by the fact that the farmers agreed to contribute $44,607 for construction of 59,200 linear feet of open ditch and 52,000 linear

feet of tile drain, at an average cost of $28.67 per acre.

The Montgomery County Soil Conservation District, Illinois, summarizes 1943 accomplishments as follows:

"In February 1943 a dragline was loaned to the district by the Soil Conservation Service. During the year, 11 drainage plans were prepared and the ditches cleaned out, benefiting 13,157 acres. Work was completed in ttime to affect approximately 3,000 acres for 1943 production.

"The past spring was extremely wet and the ditch cleanouts showed immediate results. In fact, many farmers felt that the increase in production this year alone has more than paid for their share of the entire assessment. Through district cooperation and available equipment it is estimated that 80 percent more ditch cleanout has been done than would be possible by any other means.

"Based on past experience it is estimated that a direct saving in cost of ditch cleanout of approximately $10,000 was effected to the farmers of this county by the district drainage program. The above saving does not take into account the value of the increased crop production, due to better drainage. We feel that our drainage work has made a contribution to food production during this war period, when this country and our allies need more food. It is estimated that the work done on drainage in 1943 should under average wet conditions account for an increase of 48,400 bushels of corn and 20,700 bushels of soybeans in 1944."

There is a great need for drainage work in Iowa. Much of the best agricultural land in the State is the land which has been drained. The largest concentration of work is in the north central part of the State. The first soil conservation district in that territory was the Webster County District, which recognizes drainage as an important practice. An older district is the Page County District, which reported as follows:

"Due to the interest in drainage in this section of the State, an engineering specialist has been located at Shenandoah to direct the drainage activities and do whatever design work is necessary on such projects.

"During 1943, requests were received for drainage assistance in 12 different areas. The largest of these areas comprises 700 acres of otherwise wet land and the small areas average about 40 benefited acres. Plans and designs have already been completed on the large 700-acre tract for which a drainage district has been legally organized. One smaller job has been surveyed and designed and the estimates for both of these jobs are in the hands of contractors for bids.

"There is need for a full-time survey crew in this territory to facilitate and hasten the drainage program."

A little over a year ago the Agricultural Adjustment Administration and the Soil Conservation Service entered into an agreement to furnish special assistance on drainage work in the Red River Valley of North Dakota. This agreement was made in response to a request for assistance due to particularly severe damage on nearly half a million acres in the flat lands. Much of this was under water all summer. As a result of the special program, 15 jobs, involving 691,197 cubic yards, had been planned and approved up to September 15, 1944. Practically all of this area was brought within organized soil conservation districts in the last year. Drainage is accepted as a major concern. The following soil conservation districts have a large interest in land drainage:

Three Rivers, 363,791 acres; Southeast Cass, 210,669 acres; Rush River, 203,932 acres; Antelope, 322,745 acres; Fairmount, 274,938 acres; Southeast Traill, 146,560 acres; Northeast Traill, 173,440 acres; Eastern Grand Forks County, 292,480 acres; East Pembina, 364,880 acres. The solution of many of the drainage problems in this arear will require the building of community outlets, laterals, and farm drains, and in this work the soil conservation districts will have a major role.

Drainage conditions differ in the Midwest as compared with other sections. Outlet drainage was accomplished through open ditches at an original cost usually ranging from $3 to $10 per acre. Farmers had to resort to title for the drainage of heavy soils, at a cost running $20 to $40 per acre, or even higher. The land thus drained was usually very productive, most of it having a sales value of $75 to $150 an acre before the war. Farmers are accustomed to handling their drainage problems through organized drainage districts. In the States of Minnesota, Wisconsin, Michigan, Iowa, Illinois, Indiana, Ohio, and Missouri there are 52,923,988 acres of the 86,967,039 acres in drainage districts in the United States.

In other sections of the country drainage has had a more limited application. Many successful projects have been developed in the delta lands of the Mississippi valley. In still other areas drainage has moved forward more slowly. Unfortunately,

at times in the past, numerous ill-conceived drainage districts were organized in southern States, which resulted in large losses to investors and landowners. Some of them were forced through against bitter opposition.

During the first world war, or just preceding it, much work was started but not completed until the arrival of low agricultural prices after the armistice. Some of these projects were unsound in construction and design. In the South many small systems were installed, draining bottom lands in mill areas. As an example of high cost, the average cost per acre of the open ditches in Georgia was $23.48. Many of these systems were not maintained. The ditches filled up and financial loss occurred. Naturally, public sentiment developed against drainage of any kind, sentiment which has changed only with sound engineering and the application of common sense. No wonder, when we note how many main drains were constructed without providing farm drains and laterals! Furthermore, there were no changes in land uses based on land capabilities.

Many of these deficiencies are being corrected through soil conservation district programs. In undertaking drainage work through the program of soil conservation districts, sound engineering is provided for main drains. Adequate farm drains are planned in connection with farm conservation plans and the capability of each acre is determined. What this has meant is illustrated by work accomplished by the Lynches River Soil Conservation District, Lee County, S. C. This district gave assistance to the Atkins County Drainage District, comprising 14,500 acres of land lying in the southeast portion of Lee County. A major change was necessary in the main drainage system and two new drains were designed and constructed. As of June 30, 1944, completed work totaled 10.1 miles of ditches, providing major outlets for some 8,000 acres of land in the drainage districts. This was undertaken as a demonstrational job. The Soil Conservation Service furnished special assistance, including the loan of two draglines to the supervisors of the soil conservation district. Better drainage increased crop yields from 5 to 100 percent. Practically all of more than 100 farmers living in the drainage district applied for farm conservation plans.

This job created considerable interest in drainage in the coastal plains of the State. As a result, all coastal areas of the State have now organized into soil conservation districts. South Carolina was the second State to be fully covered by soil conservation districts. Good progress has been made with drainage work in other parts of the State, technical assistance only being furnished and farmers paying the entire construction costs. One of the larger and more successful jobs is the Great Swamp drainage job in the Jasper County Soil Conservation District. The job was undertaken by a land owner who had a large acreage, although the job was of the size ordinarily associated with group jobs. The work involved 8½ miles of main ditch, laterals, and farm drains, and the estimated cost was $27,443. The average cost was $11.08 per acre on the 2,477 acres benefited. A farm plan was worked out based on land capabilities. About 500 acres was scheduled to go into cultivation in 1944 and the remaining 2,000 acres are to come into production during the next two years. The development of this land and an additional area of 1,500 acres for permanent pasture should make it possible to increase from 160 breeding cattle to 1,200 cattle. The production of hogs will be increased from 300 to 400 animals per year. Turkeys will be increased from 5,000 to 20,000.

Other good drainage developments have been secured in adjacent counties in the coastal plains through soil conservation districts furnishing technical assistance only.

The Upper West Red River Soil Conservation District, Mansfield, La., expressed the view that additional assistance would be required to solve its drainage problems:

"Drainage is a problem about which the district is concerned, and will continue to be concerned about until it is solved. Through the Soil Conservation Service, demonstrations on drainage were put on during the year. The results secured in production increases are unbelievable in many instances. Mr. Roach appeared before the board on one occasion, reporting on the drainage done on his farm. According to Mr. Roach, it meant the difference between a bumper crop and a complete failure. Several other farmers have made similar statements regarding drainage.

"Drainage requires such a large expenditure of funds, the use of such heavy machines, and involves so many other problems that it is the opinion of this board that it will be impossible for the district to carry out the program as it should be until financial assistance from outside sources is supplied."

Along the same line is the report of the Potomac Valley Soil Conservation District, Moorefield, W. Va.:

"We hope to get heavy equipment to construct diversion ditches, farm ponds, drainage ditches, and stream channels. Under present operating conditions, a major portion of the cost of operating this equipment must be borne by individual farmers. While some of our cooperators, both present and anticipated will be able to finance this operation, we believe there will be many of the low income group who can not reasonably be expected to bear the entire expense. It may be that we will have to find some way to supplement the expense of such operations."

Interest in farm drainage is increasing. An example of district interest in shallow V-type ditches is shown by the report from the Richland Creek Soil Conservation District, Barbourville, Ky.:

"The Supervisors are of the opinion that the 409 acres of wet land reclaimed by the District in 1943 was its greatest contribution to the farmers in this district. This was accomplished largely by constructing open V-ditches. . . . Approximately 25,000 feet of this type ditches were built during the year, having an average depth of about two feet, and side slopes flat enough for the farmers to keep them clean with a mowing machine.

"Most of these ditches are designed to do two things: first, to dispose of surface water, and second, to intercept and dispose of seepage water. In most cases they seem to be doing this very well. For instance, the W. N. Adams farm where we built about 600 feet of ditch was visited two or three days after a rain. A slightly depressed area, which heretofore had been a marsh all winter long, was firm and had no water standing on it at all. Also a stream about the size of a man's wrist was flowing in the bottom of the channel. This flow was 100 percent seepage since there was no surface water entering it anywhere.

"Some very encouraging results have been obtained through the use of tile. In several cases production has been increased from about one-half ton of wild hay per acre to 60 bushels of corn in one year."

The Limestone Valley Soil Conservation District, Chatsworth, Ga., reports on farm drainage accomplishments:

"The Supervisors adopted a surface drainage practice in the district this year and 1,000 acres or more has been properly drained on the cooperators' farms."

Grand Coteau Ridge Soil Conservation District, Opelousas, La., reports:

"During the latter part of the year a survey was made on 20 farms on which all or nearly all planned practices were in effect for two or more years. This survey revealed that production had been increased 40 or more percent on these farms. Below we quote some of these farmer cooperators.

"Mr. Sidney Hollier, Lafayette Parish, stated that he made one bale of cotton on 20 acres and didn't harvest any corn on 15 acres in 1940, made 3 bales of cotton, 105 bushels of corn in 1942. Mr. Hollier stated, 'All of my low yields were from lack of drainage. I had made up my mind to quit farming this 50-acre farm if I couldn't get my land drained. In 1943 a drainage program was planned for my farm. The drainage work was completed in June. On the same land as above I harvested almost 21 bales of cotton weighing 500 pounds net and 375 bushels of corn in 1943. Of course the season was some better, however, if these drainage ditches had not been there I would have lost my entire crop as happened in previous years."

"Mr. A. C. Reed, President of the Evangeline Bank and Trust Company of Ville Platte, Evangeline Parish, in a letter to the chairman of the board of supervisors said, 'The soil conservation work completed under the supervision of the Grand Coteau Ridge District in this parish has impressed us very much. This work as well as the display placed in our lobby has educated our people to the benefits to be derived from increased production resulting from terracing, drainage, and other conservation work. As you know, a large percentage of the farms in the fourth and fifth wards will be eroded beyond reclamation unless they are terraced in the near future. In the flat sections of the parish we have drainage problems to be met. Both the terracing and drainage work should be attended to without delay if we are to grow the crops so much needed by the world."

The East Central Oklahoma Soil Conservation District reports:

"There are several thousand acres of fertile land in the bottoms of the Arkansas and Canadian Rivers that would be highly productive if there were adequate protection from floods and surface drainage. Some drainage work has been done, and some special drainage surveys have been made, but accomplishments have not been great because sufficient equipment was not available. Approximately 1,196 acres have been drained. Approximately 600 acres of this drained land in the Blaine and Saylor bottoms in Haskell County produced a crop of fall spinach yielding up to three tons per acre. We expect to do more of this type of work during the coming year."

There is great interest in drainage in many soil conservation districts in the northeastern States with special interest and activity in numerous districts, especially in Maryland, Delaware, Vermont, and New York.

The Ontario County Soil Conservation District, Canandaigua, N. Y., reported as follows:

"The urgent need for food production led to adoption of a policy at the beginning of the year to expend every effort toward that end. Ontario County has thousands of acres upon which drainage systems, open and tile, have been installed. The effectiveness of many of them has been seriously impaired due to siltation of the outlets from erosion. This condition is so extreme that many areas of former cropland have been relegated to pasture or even abandonment. Others are subject to flooding and drowning out of crops, making production a hazardous undertaking. In war time especially it is unwise to risk crop loss and waste human effort and machinery. At other times it is also uneconomical. This situation is significant when it is realized that our very best land is unavailable for needed high value crops. It is roughly estimated that there are more than 100 miles of outlet drainage channel in immediate need of this attention. At least 10,000 acres of rich land would be benfited to the extent of being made suitable for cash crops, the gross value of which at present farm prices and at only average yields would exceed $2,000,000. The district, therefore, directed most of its energies toward drainage as the most extensive way of getting more food and feed quickly.

"Typical of the increased yields and help to the war effort is the Fish Creek drainage project at East Bloomfield. The estimated benefit for rehabilitating a 3-mile channel constructed by a drainage district in 1916 was more than $80,000 worth of increased production. This was made possible by an overall investment by all parties concerned of approximately $8,000, not including technical time. This project involved almost 450 acres of land, one-third of which is muck.

"Planning and construction of drainage projects has given this district an opportunity to utilize group approach unlike any other activity so far undertaken. It is the one problem in which neighbors have a common interest and must get together for solution. Moreover, it has increased contacts with landowners who may be in position to adopt other conservation measures. Drainage focuses attention on the results of erosion, siltation of the farmer's own land. To do something about it now and to make provisions for maintenance automatically calls for an admission that these rich soils have erosion. No better demonstration of the extent and cost of erosion could be asked for than ditches acting as catch-basins at the foot of sloping land. That is a very significant point in an area where the seriousness of soil washing has been overlooked. Only when landowners recognize erosion will they desire to do something about it. Thus, in drainage work it appears we have an excellent educational tool as an important by-product."

GONE WITH THE CLOUDBURSTS

(*Continued from page* 127)

May-June storms. The productive conservation way of farming demonstrated that it:

1. Helped hold the soil on the slopes and hillsides.
2. Eliminated the necessity for reworking the seedbed and replanting.
3. Enabled farmers who contoured to get the upper parts of their slopes planted while the lower parts were still too wet to work. In contrast, farmers who planted rows up and down hill waited till whole fields dried out.

But I think the biggest lesson the storms impressed on thousands of farmers was the need for a complete program of soil conservation and water management. Under the stress, the single practice couldn't be depended on to do the job.

Think of the way the farmers themselves are working together to protect their land. All over the country they have been organizing soil conservation districts with really amazing speed. In these districts, farmers are cooperating under their own leadership to safeguard their productive land, to make better use of rain water, and to increase their yields. Today, these districts include more than a third of all the farms in the country.

We must not forget, however, that a lot of work remains to be done. Erosion still impedes our food production program. It still affects a vast acreage of land, more than farmers have yet been able to protect. But I think it is entirely possible to reverse this trend of waste—this loss of soil, rainfall, and crop production—within a few years after the war.—*H. H. Bennett.*

REFERENCE LIST

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Every acre that is improved, improves, by that much, the economy of our entire nation. Soil and water conservation provide greater income, more farmer satisfaction, and increased social security on the farm. When the farmer's standard of living is raised, the Government expenditures on farm relief and rehabilitation are reduced. Back of farmer security—back of all human security—must be the security of the soil itself.

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